REMARKS

In the Office Action dated June 18, 2002, claims 1-9 are pending. The Examiner rejects claims 1-3 and 6-9 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,696,591 of Bilhorn et al. (the Bilhorn patent), and rejects claims 4-5 under 35 U.S.C. 103(a) as being unpatentable over Bilhorn in view of U.S. Patent No. 5,068,799 of Jarrett, Jr. (the Jarret patent). In response, Applicants amend claims 1, 3, and 7 to more clearly claim the invention, and amends claims 2, 4-6, and 8 for proper antecedent basis purposes, only. Applicants assert that claims 1-9 are patentable over the cited prior art.

I. Rejection Under 35 U.S.C. 102(b)

The Examiner rejects claims 1-3 and 6-9 under 35 U.S.C. 102(b) as being anticipated by the Bilhorn patent. To anticipate a claim under 35 U.S.C. sections 102(a), (b), or (e), the reference must teach every element of the claim. (See MPEP 2131.) "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." (Emphasis added) (Verdegaal Bros. v. Union Oil Co. of California; see also MPEP 2131.) "The identical invention must be shown in as compete detail as is contained in the ... claim." (Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989); see also MPEP 2131.) Further, any claim depending from base claims not anticipated by the prior art also are not anticipated by the prior art since the dependent claims comprise all of the elements of the base claims.

Bilhorn does not teach each and every element of independent claims 1, 7, and 9, as discussed below. Thus, Applicants respectfully request that the Examiner withdraw the 35 U.S.C. 102(b) rejections of the independent claims 1, 7, and 9, and dependent claims 2-6, and issue a notice of allowance for claims 1-9.

a. Independent claim 1, and dependent claims 2-6

In the Office Action, the Examiner asserts that Figure 2 teaches a smart camera which generates flaw image data. However, this assertion is not supported by Figure 2 or by the specification of Bilhorn. Bilhorn does not teach each and every element of independent claim 1. Specifically, claim 1 comprises, inter alia,

> "a plurality of smart cameras for generating a digital pixel representation of a portion of the web, each smart camera for detecting the plurality of web flaws from the digital pixel representation and for generating flaw image data and flaw location data".

Bilhorn does not teach this element of a smart camera for generating flaw image data. Rather, Bilhorn's camera includes a DSP-based camera controller 14, as shown in Figure 2, which computes accumulated average data for transfer to the host computer 16. (See column 6 Lines 15-30.) This means that all averaged data is being sent to the host computer 16 which then determines whether the average data contains "out-of-spec" conditions that indicate a flaw. (See column 6, lines 30-33.) Therefore, this reference teaches away from the present invention. The present invention, as claimed in the above element, generates flaw image data in the camera so that only the flaw image data is sent to the host computer. Thus, Bilhorn does not anticipate claim 1, and dependent claims 2-6, since each and every element of claim 1 is not taught by this reference.

b. Independent claim 7, and dependent claim 8

Bilhorn does not teach each and every element of independent claim 7. Specifically, claim 7 comprises, among other things,

> "providing at least one smart camera for inspecting at least a portion of the web, wherein inspecting at least a portion of the web comprises the steps of;
> generating flaw image data and flaw location data of the at least a portion of the web; and
> transmitting the flaw image data and flaw location data over an

ethernet to a host computer".

Bilhorn does not provide at least one smart camera which generates flaw image data for transmission to the host computer. As discussed above, the Bilhorn system sends accumulated averaged data to the host computer. The host computer then determines whether flaws exist based upon the averaged data. The present invention does not send data to the host computer for flaw detection/determination. Rather, as claimed in claim 7, at least one smart camera transmits flaw image data the computer. The host computer does not determine whether flaws exist. Thus, Bilhorn does not anticipate claim 7, and dependent claim 8, since each and every element of claim 7 is not taught by this reference.

c. Independent claim 9

Bilhorn does not teach each and every element of independent claim 9. Specifically, claim 9 comprises, inter alia,

> "averaging the digitized video stream over a distance of the web to generate an averaged background signal;
> averaging the digitized video stream over a distance of the web along a machine direction of the web to generate a filtered machine direction signal;
> averaging the digitized video stream over a distance of the web along a cross direction of the web to generate a filtered cross direction signal".

In addition to generating an average background signal as similarly disclosed in Bilhorn as "average data", the present invention generates a filtered machine direction signal in a cross direction as well as a filtered cross direction signal. Bilhorn does not teach the elements of averaging the digitized video stream in the machine and/or cross directions of the web as claimed in claim 9. The Examiner asserts that these elements are taught in column 3, lines 56+. However, Applicants cannot locate the teachings of the above discussed inventive elements of the present invention. In column 6, lines 16-36, Bilhorn discloses generating a single

average data signal for a number of image data lines as specified by the host computer. Therefore, each and every element of claim 9 is not taught by Bilhorn, and Bilhorn does not anticipate claim 9 under 35 U.S.C. 102(b).

II. Rejection Under 35 U.S.C. 103(a)

The Examiner rejects claims 4 and 5 under 35 U.S.C. 103(a) as unpatentable over Bilhorn in view of Jarrett. Applicants assert that claims 4 and 5 are not obvious under § 103 since the cited patents neither teach nor suggest the claimed invention, and since the Examiner has not presented a convincing line of reasoning as to why an artisan would have found the claimed invention to have been obvious in light of the teachings of the references. (See Ex parte Clapp, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985) ("To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references.").) Thus, Applicants respectfully request that the Examiner withdraw the 35 U.S.C. 103(a) rejections and issue a notice of allowance for claims 4 and 5.

a. Summary of the Jarrett Patent

Jarrett neither teaches nor suggests the use of a smart camera for generating flaw image data and flaw location data as claimed in claim 1. Rather, Jarrett teaches a single camera 23 which passes an analog signal to an A/D converter 24 as shown in Figure 1. In a first path, the controller 26 transfers the video data to the memory 27 of the microcomputer 29, so that a "picture" of the video image as seen by the video camera 23 is stored in the RAM 27. (Column 4, lines 20- 35.) This path as taught by Jarrett teaches away from the present invention which only transmits flaw image data to the computer.

The second path of the Jarrett system couples the output of the A/D converter 24 to a digital signal processor 28. (Figure 1, and column 4, lines 36-37.) The digital signal processor 28 analyzes the video data "in order to provide for smoothing of the data, high and low-frequency filtering of the smoothed data, convolutional analysis of the smoothed data and statistical analysis of the image in random spatial vector direction within the image. " (Column 4, lines 40-46.) Jarrett teaches that spatial filters "average a predetermined number of adjacent pixels in the horizontal and vertical directions". (Column 6, lines 67-68 through column 7, line 1.) The digital signal processor then highlights the flaws present in the image and presents this information to the microcomputer 29 in the form of cues. (Column 7, lines 17-19.) The microcomputer 29 then provides a detailed analysis of the image stored in the microcomputer RAM 27 from the first path based upon the areas identified in the cue information. In contrast, the present invention detects flaws within the smart camera and sends the flaw image as well as the flaw location to the computer. The computer displays the flaw images and utilizes flaw location data to locate the flaws on the web.

b. Summary of the Present Invention

The present invention identifies the flaws in the smart camera, and sends the flaw image data and the location of the flaw on the web to the computer. The computer is not used to detect flaws. As shown in Figures 6A and 6B of the present invention, the smart camera generates digital line scan data 340 that is transmitted to a multi-pipeline flaw detection pre-processor 310 within the smart camera. The pre-processor includes a background filter 350, a machine direction streak filter 352, a cross direction streak filter 354 and a small flaw filter 356 that process the incoming corrected pixel line scan data 340. Each 2D filter 350, 352, 354, 356 utilizes the corrected pixel data 340 to calculate running averages along a length and width of the web. The averages 400, 404, 406, 408 become

references for good product for regions local to each average. Adaptive background subtraction channels 372,374,376,378 operate on the outputs of the filters by subtracting a portion 402 of the background filtered signal 400 from the corrected signal 340, the machine direction streak filtered signal 406, the cross direction streak filtered signal 404, and the small flaw filtered signal 408. The outputs of the adaptive background subtraction channels 372,374,376,378 are coupled to multi-group thresholders 358, 360, 362, 364, 368. The multi-group thresholder detectors 358, 360, 362, 364, 368 supply a plurality of video streams that may contain flaws and defects to priority logic 370. The priority logic 370 is utilized to apply thresholds and rules to the video streams 380, 382, 384, 386, 388 to identify potential flaws. The potential flaws are processed through additional detectors and analyzers, including an inspect/reject criteria analyzer, to generate the flaw image and location information that is transmitted to the computer 332.

c. Claims 1-5

Jarrett does not teach or suggest "a plurality of smart cameras for generating a digital pixel representation of a portion of the web, each smart camera for detecting the plurality of web flaws from the digital pixel representation and for generating flaw image data and flaw location data" as claimed in claim 1. Rather, Jarrett discloses a digital signal processor which sends potential flaw cues to a computer, which in turn, determines whether a flaw exists.

Jarrect neither teaches nor suggests the elements of claims 2 and 3. Specifically, claims 2 and 3 comprise, among other things, a multi-pipeline processor comprising "a plurality of adaptive background subtraction channels connected to the plurality of filters, each adaptive background subtraction channel of the plurality of adaptive background subtraction channels producing a stream of subtracted pixel representations". Jarrett does not disclose the use of background subtraction channels in a pipeline processor contained in a smart camera. The

Jarrett system must store a reference image in the microcomputer for analysis and flaw detection.

Jarrett neither teaches nor suggests the elements of claim 4. Specifically, claim 4 defines the filters of Claim 3 as comprising a background filter, a machine direction streak filter, a cross direction streak filter, and a small flaw filter. Jarrett teaches "spatial filters that average a predetermined number of adjacent pixels in the horizontal and vertical directions". (Column 6, lines 67-68 through column 7, line 1.) Thus, Jarrett fails to teach or suggest the background filter and the small flaw filter.

Claim 5 further defines the thresholders of Claim 3 as comprising a single pixel flaw detector, a uniformity detector, a machine direction streak detector, a cross direction streak detector, and a small flaw detector. Jarrett only discloses machine and cross direction filters, and only suggests "thresholding" in column 6, lines 46-47, where he states that "the flaws can be detected by thresholding". However, since he only discloses machine and cross direct filters, he does not teach or suggest a single pixel flaw detector, a uniformity detector, and a small flaw detector either explicitly or impliedly as claimed in claim 5.

III. SUMMARY

For a reference to anticipate a claim under 35 U.S.C. 102(b), the reference must teach each and every element of the claim. The Bilhorn patent is cited by the Examiner in the 35 U.S.C. 102(b) rejection of claims 1-3 and 6-9. However, the Bilhorn patent does not teach or suggest each and every element of these claims. Thus, Applicants respectfully request the Examiner to withdraw the rejections under 35 U.S.C. 102(b) and issue a notice of allowance for claims 1-3 and 6-9.

For claims to be unpatentable under 35 U.S.C. 103(a), the cited references must teach or suggest the claimed invention. Neither Bilhorn nor Jarrett, alone or in combination, suggest a plurality of smart cameras that detect web flaws and

generate flaw image data and flaw location data. Thus, Applicants respectfully request that the Examiner withdraw the rejection of claims 4 and 5 under 35 U.S.C. 103(a) and issue a notice of allowance for these claims.

Should the Examiner believe that prosecution of this application might be expedited by further discussion of the issues, he is invited to telephone the attorney for Applicants at the telephone number listed below.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

On page 9, the paragraph starting on line 1 and ending on line 11, is amended as follows:

Referring to Figure[s 1 and] 2, the smart camera system of the present invention 50 integrates an acquisition sensor of the camera 22 or frame grabber module 24, a pipeline pre-processor 26, and an image analyzer processor 28 of the prior art into a single smart camera box 60. Required bandwidth is minimized since only detected flaws and defects of the inspection and corresponding flaw position information are communicated to the host computer 58 through ethernet outputs 64 to an ethernet hub 62. Thus, off-the-shelf ethernet cables 64 may be utilized between the smart cameras 60 of the present invention and an ethernet hub 62.

IN THE CLAIMS

1. (amended once) A [system for] web inspection <u>system for detecting a plurality of web flaws</u> of a web, the <u>web inspection</u> system comprising:

a plurality of smart cameras<u> for generating a digital pixel representation of a portion of the web</u>, each smart camera for detecting [a] <u>the</u> plurality of web flaws from [a streaming video signal] <u>the digital pixel representation and</u> [, each smart camera having means] for generating flaw image data and flaw location data;

a host computer for controlling the [low contrast] web inspection system and for [accepting] <u>receiving</u> and displaying the flaw image data and the flaw location data; and

an ethernet for connecting the plurality of smart cameras to the host compute<u>, wherein the flaw image data and the flaw location data is transmitted over the ethernet from the plurality of smart cameras to</u>

the host computer.

2. (amended once) The web inspection system of claim 1, wherein each smart camera of the plurality of smart cameras comprises:

a line scan camera for generating [a] the digital pixel representation of a portion of the web;

a lighting uniformity and pixel sensitivity correction means for correcting each pixel of the digital pixel representation and for providing a corrected pixel representation;

a web edge detector for detecting at least one edge of the web;

a multi-pipeline pre-processor for filtering the corrected pixel representation, the multi-pipeline preprocessor generating a prioritized data stream of potential flaws;

a run length encoder for generating location data regarding a location of each group of the potential flaws in a cross direction;

a blob detector for generating block data regarding the location of blocks of the potential flaws along a machine direction; and

an inspect/reject analyzer for determining actual flaw data from the prioritized data stream of potential flaws.

3. (amended once) The web inspection system of claim 2, wherein the multi-pipeline processor comprises:

a plurality of filters for averaging the corrected pixel representation over a distance of the web along a machine direction of the web;

a plurality of adaptive background subtraction channels connected to the plurality of filters, each adaptive background subtraction channel of the plurality of adaptive background subtraction channels producing

a stream of subtracted pixel representations;

a plurality of thresholders, each thresholder of the plurality of thresholders connected to an output of an adaptive background subtraction channel of the plurality of adaptive background subtraction channels, each thresholder for grouping [a] at least a portion of the stream of subtracted pixel representations and for producing an thresholder group output; and

a priority logic circuit for prioritizing the thresholder group output[s] of each of the plurality of thresholders.

4. (amended once) The web inspection system of claim 3, wherein the plurality of filters comprises:

a background filter;

a machine direction streak filter;

a cross direction streak filter; and

a small flaw filter.

5. (amended once) The web inspection system of claim 3, wherein the plurality of thresholders comprises:

a single pixel flaw detector;

a uniformity detector;

a machine direction streak detector;

a cross direction streak detector; and

a small flaw detector.

6. (amended once) The web inspection system of claim 1, wherein each smart camera of the plurality of smart cameras detects the plurality of web flaws from the

[streaming video signal] the digital pixel representation at a contrast approaching a signal noise level.

7. (amended once) A method for low contrast web inspection of a web, the method comprising the steps of:

providing at least [on] one smart camera for inspecting at least a portion of the web, wherein inspecting at least a portion of the web comprises the steps of;

generating flaw image data and flaw location data of the at least a portion of the web; and

transmitting the flaw image data and flaw location data over an ethernet to a host computer; and

displaying the flaw image data and flaw location data on the host computer.

8. (amended once) The method of claim 7, wherein the step of generating flaw image data and flaw location data comprises the steps of:

generating a pixel representation of the at least a portion of the web;

correcting the pixel representation for a lighting uniformity and a pixel sensitivity;

filtering the corrected pixel representation utilizing a plurality of filters;

grouping the filtered corrected pixel representations to generate a plurality of potential flaw data streams;

generating a prioritized data stream from the plurality of potential flaw data streams;

generating cross direction location data regarding a location of the prioritized data stream;

generating block data regarding the location of blocks of the prioritized data

stream along a machine direction; and

determining actual flaw data from the prioritized data stream of potential flaws utilizing the cross direction location data and the block data.